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Performance indices of four crossbred broiler chickens intensively managed in South West, Nigeria

Sanda, A. J.*, Adebayo, S. V., Adenaike, A. S., Wheto, M., Durosaro, S. O. & Olowofeso, O.

Department of Animal Breeding and Genetics, Federal University of Agriculture,
P. M. B. 2240, Abeokuta, Nigeria

***Corresponding author:** sandaaj@funaab.edu.ng*

***Target audience:** Poultry breeders, poultry farmers, commercial broiler producers*

Abstract

A total of 424 birds were used for this study comprising 24 parent stocks of exotic and indigenous chickens and 400 crossbred genotypes generated from the parent stocks. Two each of Arbor Acre and Marshall Cocks were mated to 20 indigenous hens of two ecotypes (Normal feather and Naked Neck) to generate 400-day old chicks of four chicken genotypes through natural mating. Compounded feed and clean water were provided to bird's ad libitum. The four genotypes were subjected to same management from day old to 12 weeks of age. The average body weight of the chicks for the four chicken genotypes was determined at day old while live weight was taken on weekly basis starting from 1-12 week of age. There were significant ($p < 0.05$) differences for body weight and the three linear body dimensions measured among the genotypes at different weeks and between sex at all weeks. The males were significantly superior to their female counterparts from one to twelve weeks with the males recording 2031.01g and the female 1503.48g at twelve weeks old. The crossbred resulting from Marshall X Normal indigenous and Arbor Acre X Naked neck chickens performed better in body weight, Breast girth and wing length at twelve weeks of age.

***Keywords:** Body weight, chicken, crossbred, genotype, indigenous*

Description of Problems

Traditional chicken production, under which most indigenous birds are managed is based on scavenging domestic fowls *Gallus domesticus*. This system has been described as a low input-low output system where birds are provided with limited amount of feed to supplement their feed resources (1). The low-input output system presupposes that an improvement in the input might correspondingly improve output. However, improvement will result when both the environment and genetic factors are considered simultaneously. Genetic progress under a free range and random mating systems observed in the Nigeria local chicken is low due to non-directional-selective mating coupled with progeny selection which can bring about significant genetic improvement especially in animal species with a short generation interval (2).

The indigenous chicken represents a huge reservoir of chicken genome. Their continued use in a small-scale village production system serves as a cheap in *situ* conservation technique that needs to be encouraged and supported (3). The frizzle and naked genes in particular have been described as adaptable genes acting as sex marker and disease resistance factor (4). Therefore, indigenous chicken needs to be maintained for the purpose of conserving the wide gene pool that they represent. The most common method of improving the local gene pool is crossing indigenous and exotic birds and then leaving the hybrid offspring to natural selection. There is a wide gap between indigenous chicken and exotic breeds raised under harsh environmental condition.

Arbor Acre strain is bred to produce chicken efficiently through consistent parent performance, excellent broiler performance and good processing yield, the broiler farmer will profit from the excellent growth rate, feed conversion and livability of the Arbor Acre broiler. In markets where broilers are still mostly sold whole, the conformation of the breast is sure to attract the consumers' attention. The average body weight of Arbor Acre broiler chickens at 10 weeks are 3.8 kg and 4.3 kg for female and male respectively (12). Marshall strain of broiler chicken is the ultimate broiler for deboning and total meat yield with the following traits. Highest meat and breast yield, excellent FCR at high body weight, meat production at lowest cost, high livability, excellent uniformity, rapid growth rate, developed to perform in extreme conditions, increased resistance to diseases, etc.

Crossbreeding indigenous chicken with exotic breed will go a long way in improving the performance of the indigenous without necessarily losing its adaptive potentials, as their desirable gene for instance diseases resistance are conserved. This will enhance better productivity of these indigenous stocks and further help in planning sustainable breeding programmes at all times. The gene that controls the naked neck trait supported better feed efficiency, growth carcass consumption, meat yield and better tolerance to high ambient temperature (5; 4). Genetic variability and relatedness among the native and improved breeds of chicken are necessary information required because the genetic variation is considered as the primary biological resource that can be exploited in selective breeding programmes.

Selection and crossbreeding offer ways through which genetic variation can be leveraged so as to improve poultry productivity (6). The use of first filial generation (F_1) crossbreds in production offers a means through which rapid improvement can be achieved in ways that combine desirable characteristics of each of the crossed breeds, to produce an individual that exhibits a more desirable mixture of traits than is possible with either alone. Unlike the case with purebred, segregation which occurs during further breeding of F_1 animals can markedly destroy favorable combinations of genes contributed by the original parents, thereby increasing variation within and between desirable traits, thus reducing overall productivity of subsequent generations if unselected, there is therefore a need for recurrent cross-breeding to produce F_1 animals for production (6).

In view of the importance of exotic broilers and local chicken strains to the socio-economic wellbeing of Nigerians, a thorough evaluation of the performance of four common crossbred meat type chickens was undertaken to help guide poultry farmers and breeders on the choice of crossbred(s) to procure for increased meat production

Materials and Methods

Experimental site

The experiment was carried out at two locations in Abeokuta. The first site was at the Poultry Breeding Unit of the Directorate of University Farms (DUFARMS) of the Federal University of Agriculture, Abeokuta (FUNAAB) Ogun State, Nigeria. The site is on latitude 7°10°N and 3°2°E. The other site was the Poultry Unit of the Institute for Food Security Environmental Resources and Agricultural Research (IFSERAR), FUNAAB located at Ogun-Osun River Basin along Alabata Road, FUNAAB. This site is on latitude 7°13°N and 3°31°E. Both sites are in Odeda Local Government Area, Ogun State, Nigeria.

Mating pattern

The birds were mated naturally using floor mating system in ratio 1: 10 (i.e. one cock to ten hens). The mating patterns used are presented in Table 1.

Table 1: Mating patterns used for the broiler and local chickens

Cock ♂	Hen ♀	Resulting chick genotype
Abor Acre (AB)	Normal Feather (NM)	ABNM
Abor Acre (AB)	Naked neck (NK)	ABNK
Marshall (M)	Normal Feather (NM)	MNM
Marshall (M)	Naked neck (NK)	MNK

ABNM: Arbor Acre X Normal Feather, ABNK: Arbor Acre X Naked neck, MNM: Marshall X Normal Feather, MNK: Marshall X Naked neck.

Egg collection, incubation and hatching

Each egg laid was numbered to identify its sire and dam and the eggs were collected on a daily basis, only eggs with good shape and unbroken shells were separated and stored for one week in a cold room at 10 to 14^{0}C and 75-80% relative humidity. The eggs were cleaned, disinfected and fumigated before setting them in the incubator. The eggs were partitioned in the hatchery to identify the chicks based on their genotypes after hatching. On the 18^{th} day, the eggs were candled to separate fertile eggs from non-fertile eggs, and on the 21^{st} day of incubation the hatched chicks were vaccinated against Newcastle Disease via intraocular route of administration before transporting to the pen where they were housed based on their genotypes.

Table 2: Effect of genotype and sex on body weight (g) from week 2 to 12 (LSM±SE)

Genotype/sex	Week					
	2	4	6	8	10	12
ABNM	178.01±5.62 ^{a}	376.94±14.06	673.28±27.04	1099.60±40.83	1436.96±55.41	1742.75±60.53
ABNK	185.23±7.47 ^{a}	357.97±18.86	714.22±35.92	1030.64±54.25	1479.17±73.63	1837.62±80.43
MNM	159.12±7.15 ^{b}	383.07±17.88	701.79±34.39	1055.20±51.93	1475.32±70.48	1843.86±76.99
MNK	161.88±5.77 ^{ab}	333.09±14.43	635.31±27.76	950/96±41.92	1351.38±56.80	1644.78±62.15
SEX						
MALE	1.88.50±4.69 ^{a}	397.53±11.72 ^{a}	768.72±22.55 ^{a}	1178.55±34.05 ^{a}	1657.61±46.22 ^{a}	2031.01±50.49 ^{a}
FEMALE	1.53.63±4.58 ^{b}	327.10±11.45 ^{b}	593.57±22.03 ^{b}	889.63±33.26 ^{b}	1213.80±45.15 ^{b}	1503.48±49.31 ^{b}

$^{a, b, c}$Means with different superscripts in the same column are significantly different (P<0.05)

ABNM= Arbor Acre x Normal, ABNK= Arbor Acre x Naked neck, MNM= Marshall x Norm al, Marshall x Naked Neck

Experimental birds

A total of 424 birds comprising 24 parent stocks (exotic and indigenous chickens) and 400 crossbred genotypes generated from the parent stocks were used for this study. Two each of Arbor Acre and Marshall Cocks were mated to 20 indigenous hens of two ecotypes (Normal feather and Naked Neck) to generate a total of 400-day old chicks of four chicken genotypes (100 each per genotype) through natural mating. The parent stocks were obtained from the Animal Breeding Unit of DUFARMS, FUNAAB, Ogun State and the chicks were hatched in the PEARL (Programme for Emergence Agricultural Research Leaders) Hatcheries of FUNAAB. Each genotype was housed in a separate deep litter pen at day old. Brooding was done for two weeks and the birds were reared for a total of 12 weeks following standard routine and occasional management practices described by (7).

Table 3: Effect of genotype and sex on breast girth (cm) from week 2 to 12 (LSM±SE)

Genotype/sex	Week					
	2	4	6	8	10	12
ABNM	8.42±0.11	6.95±0.11	13.56±0.21^{a}	15.12±0.25	17.59±0.30^{a}	19.27±0.28^{b}
ABNK	8.53±0.15	6.93±0.15	13.66±0.28^{a}	15.55±0.33	17.85±0.40^{a}	20.04±0.37^{ab}
MNM	8.32±0.15	6.57±0.15	13.36±0.27^{a}	15.65±0.32	17.99±0.39^{a}	20.56±0.35^{a}
MNK	8.23±0.12	6.91±0.12	12.46±0.22^{b}	14.78±0.26	16.44±0.31^{b}	18.87±0.29^{b}
SEX						
MALE	8.53±0.10	11.12±0.13^{a}	13.69±0.18^{a}	15.69±0.21^{a}	18.12±0.25^{a}	20.46±0.23^{a}
FEMALE	8.22±0.09	10.39±0.13^{b}	12.83±0.17^{b}	14.86±0.20^{b}	16.82±0.25^{b}	18.90±0.23^{b}

$^{a, b, c}$ Means with different superscripts in the same column are significantly different (P<0.05)
ABNM= Arbor Acre x Normal, ABNK= Arbor Acre x Naked neck, MNM= Marshall x Normal, Marshall x Naked Neck

Table 4: Effect of genotype and sex on thigh length from week 2 to 12 (cm) (LSM±SE)

Genotype/sex	Week					
	2	4	6	8	10	12
ABNM	4.68±0.07	6.95±0.11	8.99±0.14^{a}	10.70±0.13	11.98±0.12	13.68±0.16^{a}
ABNK	4.85±0.10	6.93±0.15	8.73±0.18^{ab}	10.54±0.17	11.70±0.17	12.88±0.21^{c}
MNM	4.75±0.09	6.57±0.15	8.28±0.17^{b}	10.75±0.16	11.77±0.16	13.39±0.20^{ab}
MNK	4.58±0.07	6.91±0.12	9.01±0.14^{a}	10.54±0.13	11.66±0.13	12.95±0.16^{bc}
SEX						
MALE	4.84±0.06^{a}	6.94±0.10^{a}	9.02±0.11^{a}	10.95±0.11^{a}	12.04±0.10^{a}	13.65±0.13^{a}
FEMALE	4.58±0.06^{b}	6.74±0.10^{b}	8.49±0.10^{b}	10.32±0.10^{b}	11.52±0.10^{b}	12.80±0.12^{b}

$^{a, b, c}$ Means with different superscripts in the same column are significantly different (P<0.05)
ABNM= Arbor Acre x Normal, ABNK= Arbor Acre x Naked neck, MNM= Marshall x Normal, Marshall x Naked Neck

Feed and Feeding

The birds were fed *ad libitum* with a commercial broiler starter feed containing 23% crude protein and 2840 kcal/kg metabolisable energy (ME) from day-old to 5 weeks of age, and also with commercial broiler finisher feed containing 19% crude protein and 2875 kcal/kg ME from 6 to 12 weeks of age. Clean drinking water was also provided *ad libitum* to all the birds. The four genotypes were subjected to same management from day old to 12 weeks of age, although they were separated into four different pens. The vaccination and medication programmes for the birds were also same throughout the experimental period.

Table 5: Effect of genotype and sex on wing length (cm) from week 2 to 12 (LSM±SE)

Genotype/sex	Week					
	2	4	6	8	10	12
ABNM	9.56±0.12a	12.72±0.15a	14.77±0.20	17.71±0.20	19.24±0.20	20.96±0.24
ABNK	8.93±0.16b	12.18±0.20b	14.84±0.27	17.53±0.27	19.32±0.27	20.81±0.32
MNM	9.27±0.16a	12.14±0.19b	14.42±0.26	17.99±0.25	19.65±0.26	21.25±0.30
MNK	8.26±0.13c	12.02±0.15b	14.56±0.21	17.20±0.21	19.24±0.21	20.55±0.24
SEX						
MALE	9.20±0.10	12.60±0.12^{a}	14.99±0.17^{a}	18.23±0.17^{a}	20.45±0.17^{a}	21.89±0.20^{a}
FEMALE	8.82±0.10	11.93±0.12^{b}	14.21±0.16^{b}	16.98±0.16^{b}	18.28±0.16^{b}	19.90±0.19^{b}

$^{a, b, c}$ Means with different superscripts in the same column are significantly different (P<0.05)
ABNM= Arbor Acre x Normal, ABNK= Arbor Acre x Naked neck, MNM= Marshall x Normal, Marshall x Naked Neck

Experimental Design and Data collection

The average body weights of the chicks for the four chicken genotypes were determined at day old and following brooding, individual's bird's weight was taken on weekly basis from 1-12 week of age. Each bird was weighed with a sensitive scale to obtain the live weight. The linear body measurements (breast girth, thigh length and wing length) were measured on weekly basis using a measuring tape as described by (8, 9).

To ensure proper record keeping, the birds were left-wing tagged for identification using different colour tags for each genotype throughout the experimental period.

Growth performance evaluation

- Body weight (g): A sensitive scale was used to determine individual bird's weight.
- Breast girth (cm): The measurement of the chest circumference, around the deepest region of the breast was taken.
- Thigh length (cm): The thigh length was taken at the distance between the hock joint and the pelvic joint.
- Wing length (cm): This was measured from the distance between the tip of the phalanges and the coracoid-humerus joint.

Statistical analyses

Data collected were subjected to analysis of variance using the Randomized Complete Block Design. Duncan's Multiple Range Test was used to separate the means to ascertain if there were significant differences among genotype and between sexes. Yield equation used was of the form:

$Y_{ijk} = \mu + G_i + S_j + (GS)_{ij} + e_{ijk}$

where:

Y_{ijk} = Observation made on traits of interest (body weight, breast girth, thigh length and wing length).

μ = Overall estimate of population mean.

G_i = Fixed effect of the i^{th} genotype of chicken (i= Arbor Acre Normal Feather, Arbor Acre

Naked neck, Marshall Normal Feather, Marshall Naked neck Chicken)

S_j = Fixed effect of the j^{th} sex of chicken (j = male and female)

$(GS)_{ij}$ = Fixed effect of the interaction between genotype and sex

e_{ijk} = Random error associated with each measurement.

Table 6: Least squares means ±SE of genotype x sex interaction effect on body weight (g) and linear body measurements (cm).

Genotype	Sex	Dependent Variable	Week 2	4	6	8	10	12
ABNM	Male	BW	185.37±7.62^{a}	403.89±19.07^{ab}	749.82±36.67^{ab}	1243.70±55.38^{a}	1650.00±75.17^{ab}	1983.33±82.10^{ab}
ABNM	Female		170.65±8.26^{bcd}	350.00±20.66^{bc}	596.74±39.73^{c}	955.43±60.00^{c}	1223.91±81.44^{d}	1502.17±88.96^{d}
ABNK	Male		214.58±11.44^{a}	404.17±28.60^{ab}	841.67±55.00^{a}	1233.33±83.07^{a}	1783.33±112.75^{a}	2245.83±123.16^{a}
ABNK	Female		155.88±9.61^{cd}	311.76±24.03^{c}	586.77±46.22^{c}	827.94±69.79^{c}	1175.00±94.73^{d}	1429.41±103.48^{d}
MNM	Male		175.00±10.59^{bc}	426.43±26.48^{a}	803.58±50.93^{ab}	1208.93±76.91^{ab}	1703.57±104.39^{ab}	2080.36±114.02^{ab}
MNM	Female		143.24±9.61^{d}	339.71±24.03^{bc}	600.00±46.22^{c}	901.47±69.79^{c}	1247.06±94.73^{cd}	1607.35±103.48^{cd}
MNK	Male		179.03±7.12^{bc}	355.65±17.79^{bc}	679.84±34.23^{bc}	1028.23±51.69^{bc}	1493.55±70.15^{bc}	1814.52±76.62^{bc}
MNK	Female		144.74±9.08^{d}	310.53±22.73^{c}	590.79±43.72^{c}	873.68±66.02^{c}	1209.21±89.6^{d}	1475.00±97.88^{d}
ABNM	Male	BG	8.51±0.15^{ab}	11.05±0.21^{abc}	14.02±0.29^{ab}	15.39±0.34^{abc}	18.56±0.41^{a}	20.35±0.38^{ab}
ABNM	Female		8.33±0.17^{ab}	10.53±0.23^{bcd}	13.11±0.31^{bc}	14.85±0.37^{c}	16.61±0.44^{c}	18.18±0.41^{d}
ABNK	Male		8.83±0.23^{a}	11.18±0.31^{ab}	14.20±0.43^{a}	16.13±0.51^{ab}	18.68±0.62^{a}	21.18±0.57^{a}
ABNK	Female		8.23±0.20^{ab}	10.32±0.26^{cd}	13.11±0.36^{bc}	14.97±0.43^{bc}	17.02±0.52^{bc}	18.89±0.48^{cd}
MNM	Male		8.54±0.22^{ab}	11.44±0.29^{a}	13.91±0.40^{ab}	16.47±0.47^{a}	18.44±0.57^{ab}	20.92±0.52^{a}
MNM	Female		8.10±0.19^{b}	10.25±0.26^{d}	12.82±0.36^{c}	14.85±0.43^{c}	17.56±0.52^{abc}	20.20±0.46^{abc}
MNK	Male		8.25±0.14^{ab}	10.80±0.19^{abcd}	12.63±0.27^{c}	14.79±0.31^{c}	16.80±0.39^{c}	19.40±0.35^{bcd}
MNK	Female		8.21±0.18^{b}	10.47±0.25^{bcd}	12.29±0.34^{c}	14.77±0.40^{c}	16.08±0.49^{c}	18.34±0.45^{d}
ABNM	Male	TL	4.78±0.10^{a}	7.25±0.16^{a}	9.23±0.19^{a}	11.12±0.17^{a}	12.33±0.17^{a}	14.08±0.21^{a}
ABNM	Female		4.57±0.11^{ab}	6.65±0.17^{ab}	8.76±0.21^{ab}	10.29±0.19^{b}	11.63±0.18^{b}	13.27±0.23^{bc}
ABNK	Male		4.93±0.15^{a}	7.07±0.23^{ab}	9.08±0.28^{a}	10.88±0.26^{ab}	11.92±0.25^{ab}	13.49±0.32^{abc}
ABNK	Female		4.76±0.12^{a}	6.79±0.20^{ab}	8.38±0.23^{bc}	10.22±0.21^{b}	11.49±0.21^{b}	12.26±0.27^{d}
MNM	Male		4.86±0.14^{a}	6.49±0.22^{b}	8.59±0.26^{abc}	11.04±0.24^{a}	12.07±0.23^{ab}	13.91±0.30^{ab}
MNM	Female		4.65±0.12^{ab}	6.65±0.20^{ab}	7.98±0.23^{c}	10.47±0.22^{ab}	11.46±0.21^{d}	12.88±0.27^{cd}
MNK	Male		4.80±0.09^{a}	6.96±0.15^{ab}	9.16±0.17^{a}	10.77±0.16^{ab}	11.84±0.16^{ab}	13.10±0.20^{c}
MNK	Female		4.35±0.12^{b}	6.87±0.19^{ab}	8.85±0.22^{ab}	10.31±0.21^{b}	11.48±0.20^{b}	12.79±0.25^{cd}
ABNM	Male	WL	9.61±0.17^{a}	12.88±0.20^{a}	15.18±0.27^{ab}	18.36±0.27^{ab}	20.21±0.27^{ab}	21.96±0.32^{a}
ABNM	Female		9.52±0.18^{a}	12.57±0.22^{abc}	14.37±0.30^{abc}	17.05±0.29^{c}	18.26±0.29^{c}	19.97±0.35^{c}
ABNK	Male		9.33±0.25^{a}	12.63±0.30^{abc}	15.38±0.41^{a}	18.23±0.41^{ab}	20.71±0.41^{ab}	22.17±0.48^{a}
ABNK	Female		8.52±0.21^{b}	11.72±0.25^{d}	14.31±0.34^{bc}	16.84±0.34^{c}	17.94±0.34^{c}	19.45±0.40^{c}
MNM	Male		9.35±0.23^{a}	12.76±0.28^{ab}	14.81±0.38^{abc}	18.84±0.38^{a}	20.99±0.38^{a}	22.00±0.45^{a}
MNM	Female		9.18±0.21^{a}	11.52±0.25^{d}	14.05±0.34^{c}	17.14±0.34^{c}	18.32±0.34^{c}	20.51±0.41^{bc}
MNK	Male		8.49±0.16^{b}	12.11±0.19^{bcd}	14.61±0.25^{abc}	17.51±0.25^{bc}	19.90±0.25^{b}	21.44±0.30^{ab}
MNK	Female		8.04±0.20^{b}	11.93±0.24^{cd}	14.11±0.32^{c}	16.89±0.32^{c}	18.58±0.33^{c}	19.66±0.38^{c}

$^{a, b, c}$ Means with different superscripts in the same column are significantly different (P<0.05)
ABNM= Arbor Acre x Normal, ABNK= Arbor Acre x Naked neck, MNM= Marshall x Normal, Marshall x Naked Neck

Results and Discussion

The least square means of body weight for the four chicken genotypes is shown in Table 2. There were significant ($p < 0.05$) differences for body weight measured among the genotypes at week two with Arbor Acre x Naked neck (185.25g) and Arbor Acre x Normal (178.01g) being superior to the other two crossbreds. Also, significant ($p < 0.05$) differences were observed between sex at all weeks. The males were significantly superior to their female counterparts from week two to week twelve with the males recording 2031.01g and the female 1503.48g at twelve weeks old. At the end of the experiment, the bodyweight ranged from 1644.78 to 1843.86g with Marshall x Normal genotype (MNM) having the highest value of 1843.86g followed by Arbor Acre x Naked neck (ABNK) 1837.62g, Arbor Acre x Normal (ABNM)

1742.75g and Marshall x Naked neck 1644.78g.

Breast girth, thigh length and wing lengths were significantly ($p < 0.05$) different among the chicken genotypes (Tables 3, 4 and 5). The breast girth was significantly ($p < 0.05$) different at weeks 6, 10 and 12 with Marshall x Normal chicken genotype having the best value of 17.99 and 20.56cm at weeks 10 and 12 respectively followed closely by Arbor Acre x Naked neck genotype. At week 6, ABNM, ABNK and MNM chicken genotypes were all significantly ($p < 0.05$) superior to MNK in breast girth. The males were significantly superior to their female counterparts from week two to week twelve with the males recording 20.46cm and the females 18.90cm at twelve weeks of age. Thigh length was significantly ($p < 0.05$) different at weeks 6 and 12. At week 6, Marshall x Normal feather (9.01 cm), Arbor Acre x Normal feather (8.99 cm) and Arbor Acre x Naked neck (8.73 cm) recorded superior thigh lengths when compared with Marshall x Normal feather chicken genotype (8.28 cm). Arbor Acre x Normal feather had the best thigh length value of 13.68cm at week 12, which was closely followed by Marshall x Normal genotype with a length of 13.39cm. The other two genotypes, i.e. Marshall x Naked neck and Arbor Acre x Naked neck had thigh lengths measuring 12.95 and 12.88cm respectively at 12 weeks of age. Considering the wing lengths, there were significant ($p < 0.05$) differences only at weeks, 2 and 4 with Arbor Acre x Normal feather having the best wing lengths of 9.56 and 12.72cm at both weeks, while Marshall x Naked neck recorded the least lengths of 8.26 and 12.02cm for weeks 2 and 4 respectively.

The result of the interaction between genotype and sex showed superiority which were significantly ($p < 0.05$) different at all weeks. ABNK male recorded the best performance in most of the weeks considered for body weight, these reflected at weeks 2, 6, 10 and 12, with values 214.58g, 841.67g, 1783.33g and 2245.83g respectively, while MNM female and MNK female both recorded the least body weight values at weeks 2, 4, 6, 10 and 12 with values 143.24g, 310.53g, 590.79g, 1209.21g and 1429.41g respectively. Significantly ($p < 0.05$) higher values were observed among the male genotypic classes for the three other parameters considered. At week 12, ABNK male, had the best performance for breast girth and wing length with least squares means values of 21.18 and 22.17cm respectively while ABNM male had the best performance for thigh length with 14.08cm. The female genotypes consistently recorded the least performance in all the traits measured, ABNK female had the least interactive performance for thigh length and wing length with values of 12.26 and 19.45 cm respectively while ABNM female recorded the least performance for breast girth with a least square means value of 18.18cm.

The significant variations in the body weight and linear body measurements of the resulting progenies arising from the effects of sire genotype are consistent with the report of (10) and (11) in which breed differences had significant effect on growth performance of chickens. (13) and (14) also reported significant difference in the growth performance of different strains of birds.

The superiority of Marshall x Normal chicken genotype over others in terms of body weight, breast girth and wing length could be due to positive correlations that exist between body weight and other linear body measurements. (15) noted that body weight is a measure of the overall body growth while body growth is the sum total of body components. Values reported for breast girth in this study fall within the values reported by (16). General increase in all body measurements of birds in each genotype as age increased agrees with the reports of (17) and (18) and that age is a major determinant of growth and physiological development.

The significant effect of sex on growth traits studied at different ages is in agreement with the findings of (19, 20, 21, and 22). These authors reported the presence of sexual dimorphism in favour of males in the growth performance of strains of bird studied. Akinokun (19) and (23) attributed it to differences in hormonal profile, aggressiveness and dominance of males when feeding especially when the sexes are reared together.

The significant effect of interaction of genotype and sex on all growth parameters indicated that growth performances of male and female crossbred in each sire breed were favoured differently and this can be ascribed to the genetic make-up of the crossbred which confers better social dominance on the male crossbred than the female.

Conclusions and applications

1. In conclusion, the crossbred resulting from the mating of Marshall and Normal indigenous and Arbor Acre and Naked neck chickens performed better in most of the traits considered and at different weeks.
2. The resulting crossbred could be improved and adapted to produce better meat than the pure indigenous chicken. Hence, development of the broiler line with the locally adapted chickens could be exploited.

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